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From the Office of Public Relations
Massachusetts Institute of Technology
Cambridge 39, Mass.
Tel: UN 4-6900, ext. 2701-7

For Release SUNDAY, JULY 30, 1961

NOTE TO EDITORS:

This news release was edited by computer and set in type by a Photon machine by means of the process described in the story. The news releases were printed by offset from the output of the Photon machine. The computer converted an original text prepared on a Flexowriter into the code to control the Photon with all the necessary changes of letter style, justification and format control.

A computer, a special typewriter and a standard photographic typesetting machine have been teamed up by two scientists at the Massachusetts Institute of Technology in a system that offers many improvements over conventional methods of getting words onto paper.

With this system, a draft of any book or document can be typed on a paper tape punching typewriter—a common office machine which produces typewritten pages and at the same time punches the text in code on a paper tape. The typewritten draft then can be proofread and editing instructions -- all in simple English terms -- typed out and a correction tape produced at the same time. Working on the information from the two tapes, the computer performs all deletions, insertions and other editorial changes at high speed and itself turns out a master tape of a completely correct text. The master tape, which contains directions for the selection of letter size and style, justification and format control, is then used to operate a Photon typesetting machine. Operated at a constant high speed by the tape, the Photon machine produces a finished positive on film or paper, ready for reproduction by offset or letter press printing. In the past Photon machines have generally been operated from a keyboard.

Developed by Professor Michael P. Barnett and Mr. Kalon L. Kelley as a byproduct of their research in theoretical chemistry which involves extensive use of electronic computers, the system has these features:

-- An IBM 709 computer averaged 20 seconds per page when editing some sample material. At this rate, it could carry out the mechanics of editing a 400-page book in a few hours.

-- A Photon machine produces printed output significantly faster when driven by a computer tape than when operated from a keyboard.

-- If only a typescript is necessary, the typewriter and computer can be used alone to edit and produce corrected typewritten documents. A tape can be produced by the computer to operate the typewriter as well as the Photon machine.

-- When it is necessary to print long tables of numbers or other information created by the computer as the results of lengthy calculations and logical processes, the computer can convert these results into the Photon code and punch them on a tape. This tape can then be fed to the Photon machine which prints the results or other information with the appearance of conventional printing but without the possibility of human transcription errors.

-- Instructions that will control the Photon machine in the printing of elaborate mathematical and chemical formulae can be punched by the computer when it has been provided with descriptions of these formulae prepared on the tape-punching typewriter.

Professor Barnett and Mr. Kelley are members of M.I.T.'s Laboratory of Chemical and Solid-State Physics. Mr. Kelley is a research assistant and Dr. Barnett is an associate professor of physics and director of the recently established Cooperative Computing Laboratory. Experimental work on the system was done in cooperation with Photon, Inc. of Cambridge, Mass., and Machine Composition Co. of Boston. The IBM 709 computer in the M.I.T. Computation Center was used under a research grant from International Business Machines Corporation to the Laboratory of Chemical and Solid-State Physics.

The work began with the development of editing programs to update reports that describe computing procedures which undergo frequent modification, Professor Barnett said. Then computer programs were developed which convert information from the code of a readily-available tape-punching typewriter into that of the more elaborate Photon machine.

Although the system was developed for use in the Laboratory of Chemical and Solid-State Physics, it could find many other uses elsewhere, according to the scientists who developed it. For example, it could be used to update and reprint those books, such as manuals, dictionaries, bibliographies, catalogues, and directories, that must be revised periodically. The M.I.T. Libraries are interested in the system as a possible solution for printing such books, according to Ryburn M. Ross, associate director of libraries. A further advantage of the computer in such work is that entries in a catalogue can be given to the computer in any order. The computer can then sort them into the proper sequence and can also construct elaborate indexes at the same time.

"Looking ahead the system may find further widespread use in the printing industry," Professor Barnett said. Although the development of the system was carried out with the large IBM 709 computer in the M.I.T. Computation Center, the system also could operate with smaller computing machines, such as the IBM 1620, although not so quickly. Since a single computer could carry out the work for a print shop in only a fraction of its time, this work could be done on a computer that was shared with other users.

"In line with the present trend to use computers from a distance, sending information back and forth over telephone and telegraph lines, a central computer station could serve many print shops and authors," Professor Barnett said. "In commerce and government, where swift decisions must be based on the results of computer calculations, and time is an all-important factor, the ability to use the Photon machine to produce a well-printed and easily-read document, within minutes of the completion of a calculation, is of obvious importance in using the computer as an aid to management decision."

As examples of the editing instructions which the computer programs will use, the following instructions could be used to modify this description of the work.

> Replace "special typewriter" by "tape punching typewriter" in the first paragraph.
>
> Insert "other" before "document" in the first sentence of the second paragraph.

Run on the second paragraph.

Start a new paragraph with sentence four of paragraph two.

These instructions are decoded by the computer by means of certain computer programs (called the Shadow subroutines) which have been used extensively in other problems where instructions are given to the machine in stylized but easily understood English.

The Photon machine is unlike conventional typesetting equipment in that it makes no use of molten metal. Instead, it uses a narrow beam of light and a rotating glass disc, on which more than 50 different 26-letter alphabets may be etched on an opaque background. During each revolution of the disc, the light beam is switched on for a few millionths of a second and shines through the transparent letter, on the face of the disc, which is passing the position of the beam. Controlling the instant at which the light is switched on selects the letter through which it shines. The light is focussed by a system of lenses onto a sheet of film or photographic paper.

The instructions that the Photon machine gets from the paper tape -- which has been punched out by the computer -- control the electrical circuits that switch the light beam on and off and so select the letters to be projected, the style of lettering, and the spacing that is to be left between successive letters, words, and lines.

Professor Barnett, whose work has been mainly in the fields of theoretical chemistry, operations research and computer languages, was born in London, England on March 24, 1929. He was awarded a bachelor's degree in 1948 at King's College, London and a Ph.D. at the same college in 1952. From 1952 to 1957 he worked successively with the British Research Association, the Radar Research Establishment, and IBM United Kingdom, Ltd. He went to the University of Wisconsin in 1957 and came to M.I.T. in 1958, and was appointed to his present position early this year.

Mr. Kelley designed the computer programs for the system. He was born in Cambridge, Mass., on December 24, 1938. He attended Harvard University in 1955 and 1956, then left to work in digital computer programming for the Educational Research Corp., Cambridge, Mass. He returned to Harvard in 1958 and graduated with a mathematics degree in 1960.

MIT News Office
Room 5-111
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139-4307

Phone: 617-253-2700
Fax: 617-258-8762
newsoffice@mit.edu
http://web.mit.edu/newsoffice/www/

TO: Eric Fisher

FAX NO: (773) 834-2469
PHONE NO: (773) 702-9349

FROM: Patricia Foley
MIT News Office
Rm 5-111
77 Massachusetts Avenue
Cambridge, MA 02139-4307

Fax: 617-258-8762
Phone: 617-253-2700

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Date: 11/24/98 3:00 PM.